Port of Port Arthur, Texas, After Action Report

Introduction.

A Port Risk Assessment was conducted for the port of Port Arthur, Texas 21-23 September 1999. This report will provide the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytical Hierarchy Process (AHP); and
- Summary of risks and mitigations discussion.

Follow-on strategies to mitigate risks will be the subject of a separate report.

Process.

The risk assessment process is a disciplined approach to obtaining expert judgements on the level of waterway risk. The process also addresses the relative merit of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP)[1], the port risk assessment process involves convening a select group of expert/stakeholders in each port and conducting structured workshops to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Identification of local risk factors/drivers and selecting appropriate risk mitigation measures are thus accomplished by a joint effort involving experts and stakeholders, including both waterway users and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology hinges on the development of a generic model of vessel casualty risk in a port. Since risk is defined as the product of the probability of a casualty and its consequences, the model includes variables associated with both the causes and the effects of vessel casualties. The model uses expert opinion to weight the relative contribution of each variable to the overall port risk. The experts are then asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, the port's risk is estimated by inputting values for the variables specific to that port into the risk model. The model also produces an index of relative merit for five VTM levels as perceived by the local experts assembled for each port.

[1] Developed by Dr Thomas L. Saaty, et al to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
SEP 1999		**00-00-1999 to 00-00-1999**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Port Risk Assessment Port of Port Arthur, Texas, After Action Report	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Coast Guard Academy ,31 Mohegan Avenue ,New London ,CT,06320-8103**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**15**	

Participants.
The following is a list of stakeholders/experts that participated in the process:

Name (in sitting order)	Email Address
Mr. Tom Jackson Jefferson County Navigation District	Tjac836519@aol.com
Mr. Larry Curtin Port of Beaumont	Lmc@portofbmt.com
Mr. Orlando Ciramella Port of Port Arthur	Sales@portofportarthur.com
Mr. Tony Garza Port of Orange	Tgarza@portoforange.com
Mr. Andy Collins Barwill Shipping, Inc.	Acollins@wlusa.com
Mr. Allen Staten TDI Halter	Astaten@haltermarine.com
Captain Dennis Neef Sabine Pilots	Sabine-pilots@worldnet.att.com
Mr. Richard Graham Mobil Oil Shipping	Richard_b_graham@email.mobile.com
Mr. Steve Kelly Moran Towing	Skelly@morantug.com
Captain L. J. Hebert Port Captain, Hvide Marine	FAX 409 963 6129
Mr. Roger Conant Mobil Oil Refinery	Roger_L_conant@email.mobile.com
Mr. Larry Boutte Motiva	Lboutte@motivaenterprises.com 409 989 7493
Mr. Charlie Leblanc Military Sealift Command	charles.leblanc@msc.navy.mil
Mr. Wendell Seibert U. S. Power Squadron	WSVentura@aol.com
BMC Robert Rioux, USCG ANT Sabine	Brioux@exp.net
Mr. J. T. Ewing Texas GLO	J.t.ewing@glo.state.tx.us
Mr. A. Morris Albright Gulf Copper	www.gulfcopper.com
Doug Crafton Sabine Pilots	
Johnny Krautz Motiva	jmkratz@motivaenterprises.com 409 989 7661

Numerical Results.

Book 1 - Factors *(Generic Weights sum to 100))*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
9.0	24.7	10.4	21.5	11.8	22.6

Analysis:
The participants contributed the above scores to the National Model. They determined that the Traffic Conditions, Waterway Configuration and Long Term Consequences are the largest drivers of risk.

Book 2 - Risk Subfactors *(Generic Weights)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
9.0	24.7	10.4	21.5	11.8	22.6
% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
6.0	4.1	1.5	2.7	2.0	10.9
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
3.0	4.5	6.0	7.7	2.6	4.4
	Vol. Fishing & Pleasure Craft	Currents, Tides, Rivers	Channel and Bottom	Volume of Chemicals	Health & Safety Impacts
	2.4	2.3	4.9	7.2	7.3
	Traffic Density	Ice Conditions	Waterway Complexity		
	13.7	0.7	6.2		

Analysis:

The participants contributed the above results to the National Model. Subfactors contributing the most to overall risk under each of the six major factors were:

- For the fleet composition factor, high-risk deep draft vessels contribute twice as much risk as shallow draft.
- For traffic conditions, traffic density contributes the greatest amount of risk to the waterway.
- For navigational conditions, visibility conditions contribute the most.
- For waterway configuration, passing arrangements contribute the most followed by waterway complexity.
- For short-term consequences, the volume of chemicals contributes the most by far.

- For long term consequences, economic impact contributes the most.

Book 3 Subfactor Scales - Condition List (Generic)

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.9
c. Severe winds are frequent & anticipated	4.8
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	2.8
c. Poor visibility is frequent & anticipated	5.2
d. Poor visibility occurs without warning	9.0
Current, Tide or River Conditions	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.6
c. Transits are timed closely with tide	5.3
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.4
c. Icebreakers keep channel open	5.2
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	2.6
c. Visibility obscured, good communications	5.6
d. Distances & communications limited	9.0
Passing Arrangements	
a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.4
c. Meetings & overtakings in specific areas	5.8
d. Movements restricted to one-way traffic	9.0
Channel and Bottom	
a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	2.3
c. Mud, sand and rock outside channel	5.5
d. Hard or rocky bottom at channel edges	9.0
Waterway Complexity	
a. Straight run with NO crossing traffic	1.0
b. Multiple turns > 15 degrees-NO crossing	2.9
c. Converging - NO crossing traffic	5.3
d. Converging WITH crossing traffic	9.0
Passenger Volume	
a. Industrial, little recreational boating	1.0

b. Recreational boating and fishing	3.1
c. Cruise & excursion vessels-ferries	6.0
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.6
c. Petroleum for transshipment inland	5.3
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	2.6
c. Hazardous chemicals arrive daily	5.4
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	3.5
c. Vulnerable, dependent & small	5.6
d. Vulnerable, dependent & Large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	3.3
c. Sensitive, wetlands, ENDANGERED	5.8
d. ENDANGERED species, fisheries	9.0

Safety and Health Impacts

a. Small population around port	1.0
b. Medium - large population around port	3.0
c. Large population, bridges	6.2
d. Large DEPENDENT population	9.0

Analysis:

The participants contributed the above calibrations to the Subfactor scales for the National Model. For each Subfactor above there is a low and a high severity limit, which are assigned values of 1 and 9 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. In general, participants from this port evaluated the difference in risk between the lower limit and the first intermediate scale point as being equal to the difference in risk associated with the first and second intermediate scale points. The difference in risk between the second intermediate scale point and the upper risk limit was larger yet.

Book 4 Risk Subfactor Ratings (Port Arthur)

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
4.1	6.5	2.3	4.7	1.4	4.3
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
6.2	7.4	2.8	6.7	9.0	5.2
	Vol. Fishing & Pleasure Craft	Currents, Tides, Rivers	Channel and Bottom	Volume of Chemicals	Health & Safety Impacts
	2.8	3.0	3.0	5.2	3.4
	Traffic Density	Ice Conditions	Waterway Complexity		
	6.7	1.0	8.4		

Analysis:

Based on the input from the participants, the following top risks occur in Port Arthur (in order of importance):

1. Volume of Petrochemicals
2. Waterway Complexity
3. Volume of Shallow Draft Vessels
4. Traffic Density
5. Passing Arrangements

Book 5 (Port Arthur)

	Risk Factors						
	Fleet Composition	**Traffic Conditions**	**Navigational Conditions**	**Waterway Configuration**	**Short-term Consequences**	**Long-term Consequences**	**Relative Merit Index**
VTS	40.3	30.9	37.5	40.5	41.9	42.4	**38.4**
VTIS	20.9	28.3	23.9	25.4	23.2	24.2	**25.0**
EAIS	19.3	21.1	19.8	16.6	17.3	15.5	**18.1**
AIS	13.2	12.6	12.2	11.1	11.0	11.2	**11.8**
Improve Current System	6.3	7.1	6.5	6.3	6.6	6.7	**6.7**

Analysis:

This table shows that the participants believe that the tool of VTS will contribute the greatest potential for risk mitigation given the factors that drive risk in the port of Port Arthur. This is followed closely by VTIS. The weighting as derived from Book 5 is misleading unless placed in context of the discussions.

The focus of concern of the area's stakeholders is primarily upon the approximately 17 miles of waterway shared by deep and shallow draft vessels, where conditions resulting in movement delays or suspension impose significant costs. At present there is no coordination between movements of shallow draft and deep draft vessels, and economic stakeholders feel "at the mercy of" decisions about deep draft movements as made by pilots. Specifically, there is concern over the shallow draft industry, i.e. tug and barge and the lack of communications initiated while transiting the main ship channel creating unsafe situations with deep draft shipping.

Additionally, there was discussion over economic impacts resulting from local pilot policy during reduced visibility that created some contention among local stakeholders.

The desired mitigation outcome appears to be development of a system, which results in coordination of all movements in the shared portion of the waterway, combined with an ability to move deep draft vessels under conditions not now possible. Considerable effort will be required to obtain agreement about the nature of that system. The higher merit index values for VTS and VTIS demonstrates that desire by the local stakeholders to establish a vessel traffic management system.

Risk Factors	Risks	Mitigations
Scope		
Port area	From Sea Buoy northward to Beaumont and the Sabine River to seven miles north of Orange. Included are the two points at which the ICW joins the deep-water channel.	
Fleet Composition		
% High Risk Deep Draft Cargo & Passenger Vessels Defined in terms of poor maintenance, high accidents, type of cargo	1. Defined by the panel as vessels with a 30' or greater draft. 2. There were 3400 transits in CY 1998. 80% of the vessels carry petroleum/petroleum products. 3. Most vessels are in the order of 100,000 GRT. 4. There are very few sub-standard ships calling at the area ports. 5. In general, concerns stemming from this category of ships are adequately addressed. 6. Narrowness of channel is a general problem. 7. Ship performance, particularly responsiveness to rudder, is of concern to the pilots.	1. Key mitigators are in place for present level of traffic. 2. Larger ships are restricted to daylight movements only above "Texaco Island". 3. Pilot-agreed rules limits size of ships which can meet in channel (combined beams not more than 1/2 channel width), and movements are coordinated to prevent adverse meetings of deep draft ships. 4. One-way deep draft traffic is imposed as required, and no deep draft movements are permitted during restricted visibility. 5. Economic considerations are increasing the demand for movement under conditions not now allowed. 6. More exploration is required to develop solutions to perceived future requirements. 7. Future requirements may include movement at any time and, if so, may necessitate some form of control of shallow draft movements, development of anchorages and/or lay berths, or modifications to the channel.

Risk Factors	Risks	Mitigations
% High Risk Shallow Draft Cargo & Passenger Vessels	1. Defined by the panel as vessels with a draft less than 30'. Generally speaking, risk is considered much higher from this category than from deep draft 2. Some operators are unfamiliar with waterway. Of particular concern is lack of local knowledge about currents and channel configuration 3. The junction of the ICW and deep draft channel at Texaco Island is a location where tows have a control problem because of the current in the deep draft channel. 4. Uninspected tow boats increase risk 5. Lack of regulatory oversight with respect to oversize tows is of concern. A portion of the concern stems from the increased width of barges without a concomitant increase in tug horsepower. The larger sized tows are harder to handle and can create passing difficulties because of the combined beam of meeting vessels. 6. Many of the tugs have inadequately trained and inexperienced operators 7. Outbound fishing vessels frequently extend outriggers, widening effective beam 8. Fishing vessels are frequently difficult or impossible to communicate with on Channel 13. 9. Channel 13 is frequently abused, being used for communications appropriate to a working channel 10. 1100' tows highly susceptible to effects of wind 11. "Three wide" make-up of tows give rise to tows 108' x 800'. These increase risk both to themselves and other traffic in the waterway.	1. Improve operating practices and insure that operators are familiar with the waterway. 2. Remove unqualified operators from the waterway and provide for control of the movements of tows and commercial fishing vessels 3. Provide for control of the movements of tows and commercial fishing vessels, including coordination of movements with those of deep draft vessels. 4. Extend regulatory regime 5. More rigorous implementation of Oversize Permit process. 6. Impose more stringent requirements; remove unqualified operators from the waterway. 7. Provide for control of the movements of tows and commercial fishing vessels, including coordination of movements with those of deep draft vessels.
Traffic Conditions		

Risk Factors	Risks	Mitigations
Volume of Deep Draft Vessels	1. There were approximately 3400 deep draft transits in CY 1998. 2. Deep draft vessels, representing about 20% of all vessel calls carry 50% of tonnage moving through the area's three ports. 3. Increase in numbers of transits is expected to increase at the rate of approximately 2% per year, and the panel felt that the ships themselves are increasing in size. 4. There are insufficient anchorages and/or lay berths. This creates two problems, one of delays in movement while awaiting clear passage to/from sea and the second that once transit has commenced the vessel is committed to complete the passage.	No mitigators identified.
Volume of Shallow Draft Vessels	1. Shallow draft commercial vessels represent about 80% of the area's calls. 2. The predicted annual Increase of traffic is about 2%. 3. The percentage of chemical carriers is increasing	
Volume of Fishing & Pleasure Craft	1. Communications with transiting fishing vessels is difficult to impossible.	Rigorous enforcement of regulations, including greater enforcement presence on the waterway. Conduct an education program.

Risk Factors	Risks	Mitigations
Traffic Density	1. Traffic density varies with geographic location. The area of particular concern is that portion where ICW and deep draft traffic share the same waterway (from Texaco Island to 1000' Cut). 2. Mix of deep draft and wide tows creates passing problems because of the channel width. 3. Channel width means that relatively low densities can create problems in specific areas. 4. The panel offered the example of moored vessels being disturbed by passing shipping.	Enforcement of existing regulations and education; increase enforcement presence on waterways
Navigational Conditions		
Wind Conditions	1. Highest winds occur during passage of "norther", but except for the frontal passage wind is not a problem 2. Wind is not generally a problem for ships but can create handling problems for light tows. The "virtual beam" is increased because of crabbing.	Not a significant problem. No mitigation measures required
Visibility Conditions	1. Fog can be a major problem; traffic becomes congested and can affect movements for up to two weeks. 2. Heavy rain can briefly obscure visibility 3. When vis is down, port is down. See also economic factor.	1. Need the ability to navigate during low visibility and at night 2. Reduce the size of vessels transiting at night or during periods of poor visibility 3. Need the capability to "see" others in the waterway beyond that currently available. 4. Manage meetings, which occur at night.
Currents, Tides and Rivers	1. On occasion run-off from heavy rain/dam release creates strong currents in rivers (Beaumont area primarily).	None Identified

Risk Factors	Risks	Mitigations
	2. Vessel at No. 5 dock at the Mobil terminal can block visibility; primarily affects tows leaving terminal 3. Currents just north of Sabine can be up to 7 knots cross-channel, creating control problems for deepdraft vessels	
Ice	1. Ice is not a factor	None Identified
Waterway Configuration		
Visibility Obstructions	1. Background lighting obscures aids to navigation. Affects shallow draft more than deep draft because of aspect. 2. Bends in upper reaches of Sabine River obscures traffic 3. Structures and moored vessels at Texaco Island can obscure visibility	1. Utilize AIS coupled with electronic chart displays. 2. Review adequacy of existing ranges
Passing Arrangements	1. Risk is increased by tows entering main channels, leaving ICW and alongshore facilities 2. Ships transiting too fast can cause problems for moored vessels	Adverse meetings of deep draft ships are prevented through the practices adopted by the pilots
Channel and Bottom	1. In general, soft bottom and sides. Groundings are generally "benign". 2. Ships which transit with too little under keel clearance find that the speed of advance for given power is greatly reduced. 3. Concrete riprap and extended jetties could be a hazard	

Risk Factors	Risks	Mitigations
Waterway Complexity	1. Converging waterways add complexity at six locations 2. Air draft is limited to 146' or less. 3. A 90 degree dogleg into the west basin near Texaco Island results in tows making the turn taking up the entire waterway. 4. Absence of lay berths can be a problem. 5. There is crossing traffic at Texaco Island.	1. Complexity issues are partially addressed by rules imposed by the pilots. 2. Consider the addition of a barge shelf in the portion of the waterway shared by shallow- and deep draft vessels. 3. Enforce proper use of voice radio
Short Term Consequences		
Number of People on Waterway	1. Passenger carrying barges occasionally use the waterway 2. The levee along residential section of Port Arthur could be endangered by forceful grounding 3. Noxious plume as result of accident could affect residential areas, schools (Port Arthur) 4. Weekend use of the Port Neches Park, located near the Union Oil facility, is heavily used on weekends.	None Identified
Volume of Petroleum Cargoes	1. High volume of petroleum increases potential for spills	Put special traffic rules in place when necessary
Volume of Hazardous Chemical Cargoes	1. Noxious plume as result of accident could affect residential areas, schools (Port Arthur)	None Identified
Long-Term Consequences		

Risk Factors	Risks	Mitigations
Economic Impacts	1. Economic impact starts as soon as waterway is closed. 2-4 million dollars a day. 2. Delay can affect movement of high priority military cargo 3. Recurrent delays can cause shippers to shift to other ports 4. Availability of response assets is a significant consideration when assessing problems caused by blockage of the channel 5. Reduction of inventory makes impact occur earlier 6. Impact on fisheries not particularly significant (small number of commercial fishermen) 7. Location of incident determines the scope of the effect	None Identified
Environmental Impacts	1. Significant portion of area is environmentally sensitive 2. Effect of spill is increased by lack of current in many areas (but containment is facilitated)	None Identified
Health and Safety Impacts	1. Noxious plume as result of accident could affect residential areas, schools (Port Arthur)	None Identified